[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD FOR MANAGING A DEFECTIVE AREA ON OPTICAL DISC WRITE ONCE

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 illustrates a related art optical disc device, schematically;

FIG. 2 illustrates a diagram of a related art method for managing a defective area on a BD-RW;

FIG. 3 illustrates a diagram of a method for managing a defective area on a BD-WO in accordance with a first preferred embodiment of the present invention;

FIGS. 4 and 5 illustrate diagrams showing a method for managing a defective area on a BD-WO in accordance with second and third preferred embodiments of the present invention, respectively;

FIG. 6 illustrates a diagram of a method for managing a defective area on a BD-WO in accordance with a fourth preferred embodiment of the present invention;

FIG. 7 illustrates a diagram of a method for managing a defective area on a BD-WO in accordance with a fifth preferred embodiment of the present invention; and

FIG. 8 illustrates a diagram of a method for managing a defective area on a BD-WO in accordance with a sixth preferred embodiment of the present invention;

Reference numerals of the essential parts in the drawings

10: optical disc 11: optical pickup

12: VDR system 13: encoder

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to a method for managing a defective area on an optical disc of writable once type, such as a Blu-ray Disc Writable Once (BD-WO).

Recently, it is expected that a new type of high density optical disc, on which a high quality video, and audio data can be written for a long time, such as a Blu-ray Disc rewritable (BD-RW), is developed and put into practical use.

In the meantime, referring to FIG. 1, an optical disc device for writing/ reproducing a data on/from the BD-RW is provided with an optical pickup 11 for writing/reproducing a signal on/from an optical disc 10, a Video Disc Recorder (VDR) system 12 for processing a signal from the optical pickup 11 as a reproduced signal, or demodulating and processing an external data stream into a writable signal suitable for writing, and an encoder 13 for encoding, and providing an external analog signal to the VDR system.

Referring to FIG. 2, the BD-RW is divided into, and assigned as a Lead-In Area (LIA), a data area, and Lead-Out area (LOA), with an Inner Spare Area (ISA) and an Outer Spare Area (OSA) assigned to a fore end and a rear end of the data area.

According to this, the VDR system 12 of the optical disc device writes the external data in clusters corresponding to an ECC Block unit having a predetermined size of recording after encoding and demodulating the external signal into a signal suitable for writing, when, as shown in FIG. 2, if there is a defective area in the data area found in the middle of writing the data, the VDR system 12 carries out a series of replacement writing operation in which the clusters of data written on the defective area is written on one of the spare areas, for an example, on the inner spare area (ISA) in place of the defective area.

Therefore, even if there is a defective area in the data area of the BD-RW, the VDR system 12 can prevent a data writing error in advance by, after writing the clusters of data written on the defective area on the spare area in place of the detective area, and reading, and reproducing the data from the spare area.

However, since a method for an effective management of a defective area on the BD-WO, of which standardization is under discussion currently, is not provided yet, a solution of which is required, urgently.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

Accordingly, the present invention is directed to a method for managing a defective area on an optical disc of writable once type that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention designed to solve the foregoing problem lies on providing a method for managing a defective area on an optical disc of writable once type, in which a data written on a defective area of an optical disc, such as a BD-WO, is written and managed effectively by writing the data on other data area or a spare area in place of the defective area.

[PREFERRED EMBODIMENTS OF THE INVENTION]

To achieve these objects and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the method for managing a defective area on an optical disc of writable once type, includes a first step for detecting existence of the defective area within a writing sector after writing a data in the writing sector in a data writing operation, a second step for writing the data written in the defective area after the writing sector in succession in place of the defective area, and a third step for writing navigation information on the defective area in succession in replacement after the last writing sector when the data writing is finished.

In another aspect of the present invention, there is provided a method for managing a defective area on an optical disc of writable once type, including a first step for detecting existence of the defective area within a writing sector after writing a data in the writing sector in a data writing operation, a second step for writing the data

written in the defective area in a spare area assigned to a data area in place of the defective area, and a third step for writing navigation information on the defective area in succession after the last writing sector when the data writing is finished..

In further aspect of the present invention, there is provided a method for managing a defective area on an optical disc of writable once type, including a first step for detecting existence of the defective area within a writing sector after writing a data in the writing sector in a data writing operation, a second step for writing the data written in the defective area in a spare area assigned to a data area in place of the defective area, and a third step for writing navigation information on the defective area in the spare area when the data writing is finished.

In still another aspect of the present invention, there is provided a method for managing a defective area on an optical disc of writable once type, including a first step for detecting the defective area, and writing a data written in the defective area in a spare area or other data area in place of the defective area in a data writing operation, and a second step for writing navigation information on the defective area together with navigation information written before, cumulatively.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

FIG. 3 illustrates a diagram of a method for managing a defective area on a BD-

WO in accordance with a first preferred embodiment of the present invention, wherein, for an example, the BD-WO includes a lead-in area (LIA), a data area, and a lead-out area (LIA).

In the meantime, the VDR system 12 of the optical disc device described with reference to FIG. 1 writes data continuously on a predetermined writing sector in the user data area in writing a data, wherein the predetermined data writing sector may be set as a Defect Verify Unit (DVU) of a recording size equivalent to one or more than one physical track or cluster for detecting the defective area during data writing.

Then, after writing the data on the DVU, the VDR system 12 repeats a series of defective area detecting operation, in which the VDR system 12 reproduces the data written in the DVU, and verifies the data of being written regularly. For an example, after writing a first to a fifth clusters #1 ~ #5 continuously as a first defect verify unit DVU #1 (S10), the VDR system 12 reproduces the data written on the DVU #1 progressively, and detects defective area.

In the meantime, referring to FIG. 3, if a defective area is detected in the cluster #2 (S11), the VDR system 12 carries out a replacement writing operation in which the data in the cluster #2 stored, for an example, in an inner buffer (not shown) of the VDR system temporarily is written after the fifth cluster in succession (S12).

After the replacement writing, the VDR system 12 reproduces the data in the cluster #3 of the DVU #1 again, when, if a defective area is detected from the cluster

#4 (S13), the VDR system 12 carries out a replacement writing in which the data in the cluster #4 stored, for an example, in an inner buffer of the VDR system temporarily is written in succession to the cluster #2 replacement written in succession to the cluster #5 (S14).

Eventually, the DVU #1 becomes to have clusters #1, #3, and #5 written thereon regularly, and two defective areas, and the clusters #2 and #4 replacement written thereon in place of the defective area.

In the meantime, when a data recording having a temporal continuity (recording 1) ends while above defective area detection and replacement writing operation is continued in the DVU #1, DVU #2, ------, DVU #n repeatedly, the VDR system 12 writes navigation information after the last DVU #n for managing the defective areas and the data written in place of the defective areas.

The navigation information may be managed as Defect List (DFL) information, wherein the DFL may include a plurality of defect entries Defect_Entry each having a physical sector number of the defective area (PSN of Defective) and a physical sector number having the data written thereon in place of the defective area (PSN of Defective) and the like in relation to one another.

In the meantime, referring to FIG. 3, if another data writing operation (Recording 2) having a temporal continuity ends, the navigation information is written in succession to the last DVU.

Moreover, the VDR system 12 writes information for fast access to the navigation information written thus, for an example, a physical sector number having the defect list written thereon (PSN of Defect List), on the LIA as Disc Definition Structure (DDS) information.

According to this, in reproducing the data at the optical disc device, by reading and referring to the DDS information written on the LIA, the DFL can be searched and confirmed, and the data written in place of the defective area can be read and reproduced with reference to the defect entry on the defect list.

FIG. 4 illustrates a diagram showing a method for managing a defective area on a BD-WO in accordance with second preferred embodiment of the present invention, wherein the BD-WO includes a lead-in area (LIA), a data area, and a lead-out area (LIA), with a spare area assigned to front or rear end part of the data area.

For an example, an Outer Spare Area (OSA) assigned to the rear end part of the data area may vary a recording size (Variable Size) step by step as the defective area detection and replacement writing operation described with reference to FIG. 3 is progressed, wherein, as shown in FIG. 4, the recording size can be reduced according to recording sizes of replacement written second and fourth clusters #2 and #3, and the first defect list DFL #1 as the defective area detection operation is progressed.

In the meantime, referring to FIG. 5, when a final written location of the data does not exceed a starting written location of the OSA assigned in an initial stage of

disc production, the recording size is maintained as it is, and when the final written location of the data exceeds the starting written location of the OSA assigned in the initial stage of disc production, the recording size may be reduced.

Thus, by assigning and using the OSA having a variably reducible recording size, the VDR system 12 can minimize an error between a writable data capacity detected before starting data writing operation and an actual writable data capacity reduced due to the defective area.

FIG. 6 illustrates a diagram showing a method for managing a defective area on a BD-WO in accordance with fourth preferred embodiment of the present invention, wherein the BD-WO includes a lead-in area (LIA), a data area, and a lead-out area (LIA), with a spare area assigned to front or rear end part of the data area.

For an example, an Outer Spare Area (OSA) assigned to the rear end part of the data area has a fixed a recording size (Fixed Size) for replacement writing of the data in the defective area as described with reference to FIG. 3. Instead of the OSA, the ISA in a front end part of the data area may be assigned as the fixed recording size.

Referring to FIG. 6, the VDR system 12 carries out a replacement writing operation in which, after writing first to fifth clusters Cluster #1 ~ #5 in succession as a first defect verify unit DVU #1 (S10), the data written in the first defect verify unit is reproduced in succession, to detect a defective area, and, if the defective area is detected from the second cluster #2 (S11), a data of the second cluster is written on the

OSA (S12).

After the replacement writing operation, the data written in the third cluster of the first defect verify unit is reproduced. When a defective area is detected from the fourth cluster (S13), the VDR system 12 carries out a replacement writing operation in which the data in the fourth cluster is written in succession to the second cluster replacement written in the OSA (S14).

According to this, the first defect verify unit has first, third, and fifth clusters written regularly, and two defective areas, and the OSA has replacement written second and fourth clusters.

When a data recording having a temporal continuity (recording 1) ends while above defective area detection and replacement writing operation is continued in the DVU #1, DVU #2, ------, DVU #n repeatedly, the VDR system 12 writes navigation information after the last DVU #n for managing the defective areas and the data written in place of the defective areas.

The navigation information may be managed as Defect List (DFL) information, and, as shown in FIG. 6, when another data writing operation (Recording 2) having a temporal continuity ends, the defect list information is written after the last defect verify unit in succession.

Also, the VDR system 12 carries out a series of operation in which information for fast access to the navigation information is written in the LIA as the DDS

information.

On the other hand, as shown in FIG. 7, the VDR system 12 may write the DFL information in the OSA for management.

Thus, in reproduction of the data, the VDR system 12 searches and confirms the defect list DFL by reading and referring to the DDS information written in the LIA, and reads and reproduces the data from the OSA written in place of the defective area with reference to the defect entry on the defect list.

In the meantime, referring to FIG. 8, when data writing operations (Recording 1, 2, ----) each having temporal continuity end, the VDR system 12 writes the DLF information after each of the last defect verify units in succession, or on previous DFL, cumulatively.

For an example, the VDR system 12 carries out a series of operation repeatedly in which, after the first data writing operation (Recording 1) ends, the first defect list DFL #1 information is written after the last defect verify unit in succession, and when the second data writing operation (Recording 2) ends thereafter, the first and second defect lists DFL #1 and #2 information is written, cumulatively.

Therefore, even when the first defect list DFL #1 information written at the time the first data writing operation (Recording 1) is not read regularly, since the first and second defect lists DFL #1 and #2 information written at the time the second data writing operation (Recording 2) ends can be read and referred to, an occurrence of

major reproduction error caused by damage of important defect list information can be minimized.

For reference, application of the method for cumulative writing and managing the defect list information may be extended to another embodiment for writing and managing defect list information other than the foregoing various embodiments described with reference to FIGS. 3 to 8.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

[EFFECT OF THE INVENTION]

As has been described, the method for managing a defective area on an optical disc of writable once type permits, not only to read and reproduce a data written on a defective area of an optical disc, such as BD-WO regularly in data reproduction by writing the data on a spare area or other data area in place of the defective area and managing the data effectively, but also to minimize an error between a writable data capacity detected before starting data writing operation and an actual writable data capacity reduced due to the defective area, and occurrence of major reproduction error

caused by damage of defect list information.